

# Pixel Calibration on High Bandwidth RCE System

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The ATLAS pixel detector is expected to be upgraded by stage to meet the challenge of high occupancy and radiation dose at high luminosities. The current plan is to install another inner-most pixel layer (Insertable B-Layer: IBL) on a smaller beam pipe within the current pixel detector during 2013 shutdown and potentially replace the entire existing pixel detector in 2017. These upgrades involve potentially new type of radiation hard sensors and an improved large modern readout ASIC (FE-I4). The generic DAQ R&D Reconfigurable Cluster Element (RCE) concept originated from SLAC is built upon extensive experience from the many experiments at SLAC as an integrated entity of electronics hardware and software support implemented on the high bandwidth modern ATCA (Advanced Telecommunication Computing Architecture) platform with I/O capacity at several hundred times faster than the more commonly used VME systems in HEP. This is a primary candidate for ATLAS upgrade DAQ needs and extensive work has already under way on applying the RCE system to ATLAS pixel upgrades.

The tasks of this project will center on the application of the RCE readout on the pixel upgrade calibration needs. After initial training on how to program and run test with the RCEs, the student is expected to carry out performance benchmark studies for the pixel calibrations to identify the sources of speed limitations and examine general resource usage, then seek means of improving the calibration performance. There is also an extensive need to adapt existing pixel calibration software for the new FE-I4 readout chip for IBL/upgrade, in the official calibration framework. Depending on the rate of progress, it may be also possible to pursue more advanced exploration of the additional resources in the RCEs e.g. the DSP tiles for drastic performance gains through parallel processing. The project work mostly involve online programming in C++ on the RCE DAQ boards and associated interaction with pixel readout electronics.

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